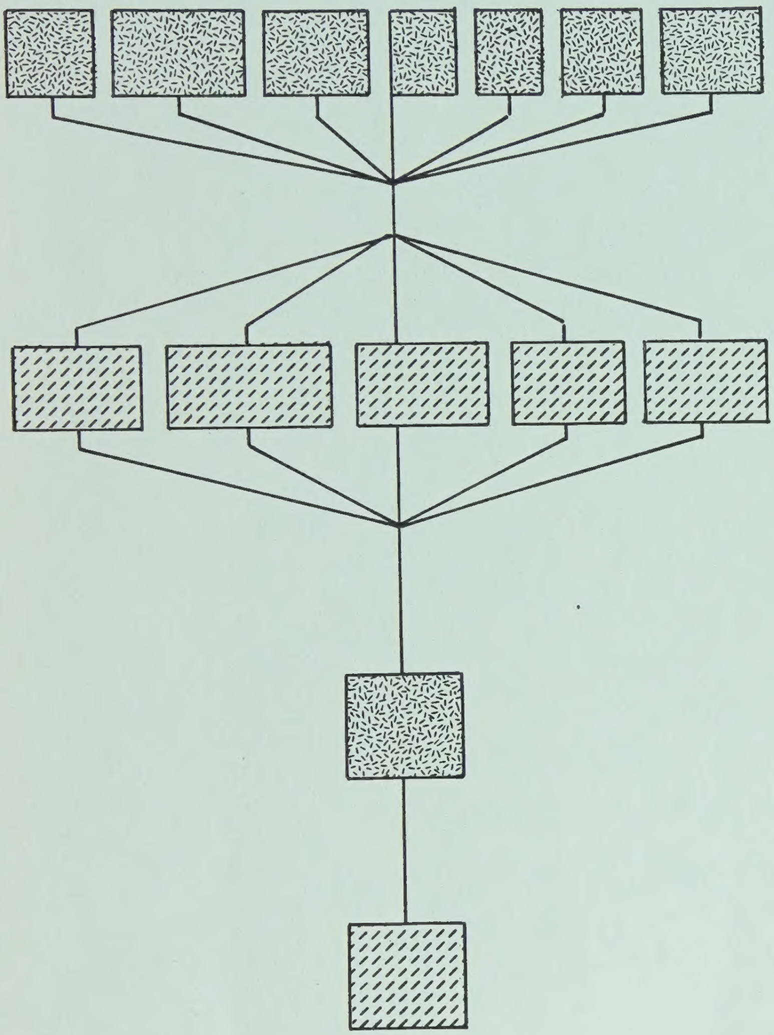
City of Merced

ENVIRONMENTAL RESOURCES MANAGEMENT PLAN



seismic safety / safety

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CITY OF MERCED

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CITY OF MERCED
Planning Commission

RESOLUTION #1134

WHEREAS, the Merced City Planning Commission at its regular meeting of August 6, 1975, considered a combined Seismic Safety/Safety Element of the Merced City General Plan; and,

WHEREAS, an environmental assessment was made and a Negative Declaration was issued upon determination by the Responsible Official (Planning Director) that no significant negative environmental impact would accrue from the goals and policies contained within this element; and,

WHEREAS, upon due public notice a public hearing was conducted on the above said date; and,

WHEREAS, no one spoke at the public hearing but a number of verbal comments, suggestions, and recommendations were received by the Planning Staff prior to the above meeting, and all comments and recommendations regarding goals and policies contained within this element were made known to the Commission by the Staff; and,

WHEREAS, the Merced City Planning Commission made the following findings:

1. The matter of community safety is of prime importance but is often overlooked until major emergencies or disasters occur.

2. The General Plan of the City of Merced does not contain a Safety element.

3. The Merced City Planning Commission approved and endorsed a preliminary Seismic Safety Element at its special meeting of March 25, 1974, which was subsequently adopted by the Merced City Council at its May 6, 1974, meeting.

4. The State of California had mandated that such elements, or a combined element, be prepared by September 20, 1974, by cities and counties within the State, but the City of Merced had requested and had received an official extension to September 20, 1975, to complete these elements.

5. The combined Seismic Safety/Safety Element has been developed following present State guidelines.

6. Planning and zoning has often been primarily concerned with reconciling physical land use problems as they pertain to the intercompatibility of prospective land uses; however, beyond this, little systematic effort has been directed towards improving the compatibility of private and public development with their environment, natural or otherwise, to temper both Man's effects on his surroundings and the impact of his surroundings upon human life and infrastructure, through both destructive natural occurrences (e.g., earthquakes) and man-caused emergencies (e.g., fires) of great magnitude.

7. The preparation of this combined element as an expansion of the City's existing Environmental Resources Management Plan is intended to assist the community through such avenues as safer land use planning, safer and more efficient use of resources such as water, and more effective long-term preparation for large and small scale community disasters.

8. The Seismic Safety/Safety Element, along with the present draft final Noise Element, and the completed Conservation, Open Space, and Scenic Highways Elements, comprise the Environmental Resources Management Plan (ERMP) portion of the Merced City General Plan.

NOW, THEREFORE, BE IT RESOLVED that the Merced City Planning Commission does approve the completed Seismic Safety/Safety Element, containing an expanded Seismic Safety portion and an initial Safety portion as modified by the Planning Commission at this meeting, and does recommend that the Merced City Council adopt this element, as modified.

AYES: Commissioners Irwin, Hart, Weber, Green, Chairman Fisher

NOES: None

ABSENT: Commissioners Passovoy, Riggs

Adopted this 6th day of August, 1975.

Chairman, Planning Commission of the
City of Merced, California

ATTEST:

Secretary

RESOLUTION NO. 75-85

GENERAL PLAN - ADOPTING SEISMIC SAFETY/
SAFETY ELEMENT

BE IT RESOLVED by the City Council of the City of Merced as follows:

1. The Seismic Safety/Safety element of the General Plan of the City of Merced, heretofore approved by the Planning Commission of the City of Merced, is hereby approved and made part of the General Plan of the City of Merced, in accordance with the provisions of Government Code §65357.

2. The City Clerk shall endorse upon the General Plan of the City of Merced, the fact of adoption of the above named element by this resolution and the date of such adoption.

Duly and regularly adopted by the City Council at its regular meeting held August 18, 1975.

APPROVED:
William P. Quigley
WILLIAM P. QUIGLEY, MAYOR

ATTEST:

ALLAN P. SCHELL, CITY CLERK
By: William H. Cunningham
WILLIAM H. CUNNINGHAM
DEPUTY CITY CLERK

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LIST OF FIGURES

*The SEISMIC SAFETY/SAFETY ELEMENT is one of five elements

I. Conservation Element
II. Scenic Highways Element
III. Seismic Safety/Safety Element
IV. Noise Element
V. Open Space Element

that together form the City of Merced's Environmental Resources Management Plan (ERMP), Volume 1 of the City's General Plan.

Pages herein are identified by a combination of Roman numerals (indicating the number of this particular element) and Arabic numerals (indicating the actual page number).

SEISMIC SAFETY/SAFETY ELEMENT

Earthquakes are a part of California's heritage, and we all must learn to live with them. But the dangers involved are more a result of man's ignorance than of nature's destructive force.

-Robert Iacopi-

INTRODUCTION

Government Code Section 65302 (f) requires all cities and counties in California to have a Seismic Safety Element "consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to the effects of seismically induced waves such as tsunamis and seiches . . . and an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves."[1] The Code Section 65302.1 requires a Safety Element for the "protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard."[2]

The Seismic Safety Element and the Safety Element, as parts of the General Plan, can encourage the development of improved land use and circulation standards and policies that recognize the dangers of fire, geologic and other hazards. Such standards and policies work toward the basic objectives of reducing loss of life, injuries, damage to property, and economic and social dislocations. The two elements have been combined into one document by the City of Merced for two reasons: one, the intent of both elements is similar in that they deal with risk

and safety factors closely related to land use planning and two, the lower incidence of seismic activity in the Merced area suggests it be treated as one of several geologic occurrences. However, the requirements for each element have been clearly distinguished and the policies dealing with each area are easily identifiable.

SEISMIC HAZARDS

An environmental factor of particular regional importance to land use planning within the State of California is the presence of seismic hazards. One purpose of this element is to identify and appraise existing seismic hazards within the planning area, and the measures taken to reduce associated damage and loss of life.

Earthquakes

An earthquake is a perceptible trembling to violent shaking of the ground, produced by the sudden displacement of rocks below the earth's surface. An earthquake indicates that stress in the earth's crustal material has been relieved. Earthquake activity can include the subsidence and landslides covered below, but most people equate earthquakes with the movement of the earth along a fault or fracture zone. The amount of damage to structures from this movement is determined by several factors: (1) distance from the epicenter or point on the earth's surface directly above the focus of the earthquake; (2) nature of the ground (i.e., buildings of essentially equivalent construction will be more severely damaged if they are on filled, unconsolidated, or water-soaked ground and less so if they are on dry, well-consolidated soil); and (3) type of construction (e.g., if the building vibrates as a single unit, it is less likely to suffer severe damage).[3]

Earthquake magnitude is usually measured in terms of the Richter scale (see Figure III-1). Other scales such as the Modified Mercalli Scale are also used (see Appendix III-A).

Figure III-1

Earthquake Magnitude on the Richter Scale

Magnitude	Approximate Energy	Magnitude	Approximate Energy
1.0	6 ounces TNT	5.5	1,000 tons TNT
1.5	2 pounds TNT	6.0	6,270 tons TNT
2.0	13 pounds TNT	6.5	31,550 tons TNT
2.5	63 pounds TNT	7.0	199,000 tons TNT
3.0	397 pounds TNT	7.5	1,000,000 tons TNT
3.5	1,990 pounds TNT	8.0	6,270,000 tons TNT
4.0	6 tons TNT	8.5	31,550,000 tons TNT
4.5	32 tons TNT	9.0	199,000,000 tons TNT
5.0	199 tons TNT		

Observations have placed the largest known earthquakes in the world at the 8.8 or 8.9 level of magnitude.

(Source: Merced County "Safety in the County of Merced," 1974, p. B-6.)

California Seismic History

The State of California has a long history of seismic activity. Faulting and associated earthquakes have played an active role in the development of California's landscape throughout geologic time. However, the earliest known account of seismic activity during recorded history dates back to the late 1700's. In 1769, the expedition of Gaspar de Portola was violently shaken by a large earthquake while camped on the Santa Ana River near the present town of Olive. The heavy shaking reportedly threw the river out of its channel and many men and horses were knocked to the ground.

All parts of the Circum-Pacific Seismic Belt are annually jolted by countless numbers of major and minor shocks, and California is no exception. Other locations around the Pacific Basin, such as Japan or the Aleutian Islands, may have more earthquakes than California, but

California still is hit by thousands of shocks every year, some 500 of which are large enough to be felt by many people. Earthquakes of destructive magnitude have occurred in California on the average of one a year for the past 50 years. Few earthquakes have received as much publicity as the 1906 San Francisco quake.

There are hundreds of earthquake faults traversing the state, including a number of major historical significance in and near the San Joaquin Valley. The nearest faults of major historical significance are the San Andreas fault to the west; the Hayward and Calaveras faults to the northwest; and the White Wolf, Garlock, and Sierra Nevada faults to the south (Figure III-2, p. III-5).

Local Historical Activity

The Merced City planning area, in turn, has no known faults crossing it; there are only two areas that have experienced faulting activity that are relatively close to the City. One, the Telsa-Ortigalita fault located in the western quarter of Merced County near the San Luis Reservoir has experienced some subsurface activity. The Stanislaus County 1974 Environmental Resources Management Element cites an earthquake of magnitude 4.0 that has occurred along this fault since 1930 and several small quakes between magnitude 2.5 and 3 were measured between 1962 and 1969. The other area, Bear Mountain Fault Zone, which lies five miles east of and parallel to the Merced County boundary, is the nearest fault to the City of Merced. An earthquake on this fault centered near Catheys Valley occurred recently (August 9, 1975), registering 4.1 on the Richter scale. There were no reports of serious damage, although one Mercedian stated that the quake had felt "like someone had crashed into the house with an automobile." (Merced *Sun-Star*, August 11, 1975)

Figure III-2

SIGNIFICANT FAULTS

SAN ANDREAS FAULT is the most publicized rift in California. It is by far the longest in the state, and it annually produces dozens of earthquakes. But despite its importance, the role of the San Andreas is often exaggerated; it is frequently blamed for every earthquake in California, and many people believe that once they move away from this great fault, they no longer need to fear earthquakes a dangerous fallacy.

CALAVERAS FAULT. There is evidence that strain is building across this fault which has been unrelieved by a major earthquake since 1868.

HAYWARD FAULT, despite its distinctive name, is really a branch of the San Andreas zone. The fault has played a significant role in the geologic development of the San Francisco Bay area, and it has also given birth to several large tremors.

SIERRA NEVADA FAULT movements have created the magnificent escarpment that forms the eastern edge of the Sierra. The Owens Valley branch of the system was responsible for the 1872 quake - one of the largest in California's recorded history.

WHITE WOLF FAULT is a short, relatively insignificant fault that taught Californians a lesson in 1952, when it unexpectedly generated the greatest earthquake to hit California since 1906. Unimpressive size and apparent inactivity can be very deceiving.

GARLOCK FAULT is the second largest fault in the state, and has made several contributions to the landscape, including the mountain ranges that form the northern edge of the Mojave Desert. Strangely enough, there has not been a single great earthquake during recorded history that can be blamed on this huge fracture.

Source: Robert Iacopi, 1964, p. 15

While it would appear that the faults of major historical significance noted above have been and will continue to be the principal sources of seismic activity affecting the planning area, it should be observed that as our knowledge of the more obscure and historically inactive faults within the Central Valley increases, additional areas of potentially severe faulting may be identified.

Nevertheless, this area has been shaken by earthquakes originating elsewhere. There is documented evidence that the planning area has been shaken by at least nine California earthquakes during recorded history, those of 1857, 1868, 1872, 1892, 1906, 1952, 1966, and 1975 (two). Four of these quakes, for which local reports are available, are further discussed in the following paragraphs.

Earthquake	Date	Magnitude*	Intensity in the City of Merced**
Owens Valley	1872	8.25 est.	V-VI
San Francisco	1906	8.3	V-VI
Arvin Tehachapi	1952	7.7	V-VI
Oroville	1975	6.1	III est.

*Richter Scale
**Modified Mercalli Scale

The Owens Valley quake of March 26, 1872, was one of the largest in California's recorded history. Seismological data is scant for this great earthquake (seismographs were not introduced until 1887), but personal accounts and comparison of this quake to other great quakes place its magnitude at not less than 8.25 on the Richter Scale.

Figure III-3

ISOSEISMAL MAPS SHOWING
THE INTENSITIES OF TWO
EARTHQUAKES USING THE
MODIFIED MERCALLI SCALE

SAN FRANCISCO 1906
EARTHQUAKE

(Source: Anderson,
1971, Page 63)

OWENS VALLEY 1872
EARTHQUAKE

(Source: Calif. Div.
of Mines & Geology,
1972, Page 60)

Ground shaking from this earthquake was felt throughout most of California and Nevada, in Arizona and Oregon, and as far away as Salt Lake City (Figure III-3, p. III-7). Most of the Central Valley experienced moderate shaking or intensities of V to VI on the Modified Mercalli Scale (see Appendix), and damage was generally limited to cracking and occasional falling of plaster. The San Joaquin *Argus* of March 30, 1872, carried the following account of what occurred at Snelling, some 17 miles north of Merced:

> *There occurred at 20 minutes past two o'clock Tuesday morning (March 26, 1872) a series of shakes and tremors of such duration as to alarm all but the heaviest of sleepers. The dumb animals were aroused to the point that dogs howled, horses neighed, and cows lowed. Chickens, turkeys, and geese were audibly awakened.*
>
> *The damage amounted to the shaking down of plaster, the displacement of chimneys of one or two buildings, and the cracking of the walls of the school building.*

While there are no available accounts of what actually occurred in the newly-organized town of Merced, it is believed that the preceding account well describes what occurred here also.

The next major earthquake to be felt in this area was the 1906 San Francisco quake. This devastating earthquake, which ranks far ahead of all other California shocks combined in terms of lost lives and property damage, shook the planning area with an intensity approaching V (see Figure III-3, p. III-7). The Merced County *Sun* of April 20, 1906, gave the following description:

> *Little damage occurred in Merced. Nearly all clocks were stopped. The first shock was felt at 5:15 a.m., April 18. At the Troy Laundry on Main Street (now 17th Street) where there is a brick oil tank under construction, the excavation filled with two feet of water and the walls of the tank were disturbed. Pools of water on vacant lots throughout the city rose [soil liquefaction?]. The earth was separated from some buildings in the city. In the Court House, at 2:30 p.m. in the afternoon, a shock was felt in the Superior Court Room where a trial was in progress. When the walls and ceiling began to crack, Attorney I.G. Ostrander ceased his argument to the jury and led the entire jury and court down the stairs.*

Although the epicenter of this quake was within 150 miles of Merced, only minor structural damage was reported. This is in contrast with the city of Los Banos, approximately 25 miles west of Merced, which sustained heavy damage. Total damage there was estimated at $100,000 (1906 dollars).

More recently, the planning area was rocked by the Arvin-Tehachapi quake of 1952. This quake of July 21, 1952, one of the largest in California history (7.7 magnitude on the Richter scale), was centered along the White Wolf fault some 200 miles south of Merced. Although this quake was felt throughout the county, local residents suffered more from fright than from damage. The only reports of damage within the Merced area dealt with cracked plaster and smashed dishes.

The Oroville quake of August 1, 1975, which registered 6.1 on the Richter scale, was reportedly felt by numerous Mercedians, although there were no reports of damage or injuries in this area of the San Joaquin Valley. The epicenter was placed about 250 miles north of Merced near the city of Oroville. The *Merced Sun-Star* of August 2, 1975, described the impact on Merced:

> *At a College Green Shopping Center restaurant, customers said the chandeliers swayed back and forth for several seconds, a similar occurrence reported by banker David Murphy who noted the sensation caused some stomach "butterflies"...*
>
> *Merced businessman Larry Hogan described what might have been the feeling of others in the city.*
>
> *Hogan, seated at his home at 663 Elise Court, said he thought he was having a heart attack.*
>
> *"I felt dizzy and started to sweat. Then I got up and got a glass of water and by that time was back to normal. I thought for sure it was a heart attack."*

Earthquake Prediction Technique

Because of the high population densities in the earthquake-prone sections of the United States and other countries including the U.S.S.R., China, and Japan, there has been an increase in research on earthquake

prediction techniques. Several methods have been developed utilizing phenomena that normally precede earthquake activity:

(1) Seismic waves: Seismically active regions experience numerous small earthquakes. Research from the U.S.S.R. indicates that these earthquakes reflect a stress pattern that "is random during the calm period but becomes highly organized beginning three or four months before the main shock. The compressional stresses become aligned in the same direction as that of the forthcoming main shock."

(2) Changes in the volume of crustal rock: The development of cracks in the strained portion of the crust causes the crustal material to expand in volume. This can be measured by recording changes in water level and also by changes in the gradient of crustal material as measured by tiltmeters or repeated surveying. Because water flows through these cracks more easily, allowing more radon (an element) to appear in the water, the increase in radon as measured in deep wells is being used as an indication of crustal stress.

(3) Changes in the Magnetic field: Unusual changes in the magnetic field near the focal region can be detected by comparing the measurements of magnetometers located near the focal point with those located at a distance.

(4) Voltage changes: "If an electric current is fed into the earth's crust between two points several kilometers apart, voltage changes between two other points will show up if the resistivity of the intervening crustal rocks changes."[4]

In an attempt to explain and understand why these changes occur prior to earthquakes, two models have been built. As a result of the models and other research, theories are being developed that visualize a connection between the duration of the unusual phenomena preceding the earthquake with the magnitude of that earthquake.

For example, an event with a magnitude of 5 on the Richter scale has an anomaly (strange condition) lasting for about four months, whereas a major earthquake, with a magnitude of 7, say, would be preceded by an anomaly beginning some 14 years before the event.[5]

Scientists in the field, and others concerned about the danger that could be lessened if earthquake prediction were more accurate, believe that too few methods are being tested in too few places. Lack of adequate funds for research and for setting up monitoring devices hinders development of a workable system. Knowing that the San Fernando tremor that struck just north of Los Angeles in 1971 (magnitude 6.6) resulted in damge of more than $500 million, it becomes more obvious that continued efforts should be made to advance the state of the art of earthquake prediction.

Hazard Appraisal

Despite the apparent seismic inactivity experienced by the Merced area, residents must remain conscious of the fact that a devastating earthquake could occur in this area with little or no warning. Contrary to popular belief, the severest earthquake to occur in the United States was not in "earthquake country" but took place in the central Mississippi Valley.

The New Madrid (Missouri) earthquake started at about 2:00 a.m. in the morning of December 16, 1811, and was felt over an area of around 1,000,000 square miles -- from the Canadian border to the Gulf of Mexico and from the Rocky Mountains to the Atlantic Ocean....

A more unlikely spot would be hard to select -- in a vast lowland plain, remote from any actively growing mountain range.[6]

Although there is a distinct absence of anything but minor structural damage associated with past ground shaking in the Merced area (there is no record of surface rupturing or earthquake triggered flooding), this does not mean that the planning area is free of seismic hazards. The Merced area is largely underlain with unconsolidated sediments of sand and gravel. These unconsolidated sediments, much of which are saturated with water, represent the poorest kind of soil condition for resisting seismic shock waves and may be susceptible to soil liquefaction in some areas (e.g., 1906 quake). This soil condition, the fact that Merced is far more urbanized today than at the time of the 1872 and 1906 quakes, and the inevitability of future earthquakes of equal magnitude all point to the possibility of future damage.

In light of recent activity, (e.g., Oroville and Catheys Valley earthquakes), more attention should be given to the earthquake potential of Sierra foothill faults, many of which have been considered inactive.

If an earthquake of high magnitude were to take place in California's Central Valley, a resident of the City of Merced could expect the following to occur: (1) most buildings constructed of rigid material such as brick or stone would suffer the greatest damage and many chimneys would snap off at the roofline; (2) buildings standing on fill or water-soaked ground would be subjected to greater stress than those on dry, packed ground; (3) if constructed, buildings below the Lake Yosemite Dam could be innundated should the dam (built in 1890) be damaged; and (4) pedestrians could be injured from breaking glass panes, falling signs, or non-structural architectural trim.

Mitigation Measures

Seismic design standards have been adopted by the City in its Building Code which meet the criteria for Seismic Zone 3. New buildings require reinforcement for structural and non-structural features to meet the expected intensity of earthquakes in Zone 3. Unsafe architectural trim could be either reinforced or removed. As more stringent standards are adopted older structures should be studied to determine need for reinforcement. For example, the only water tank known to have included consideration of seismic activity is located on McKee Road north of Black Rascal Creek. The structural conditions of older tanks should be analyzed and reinforcement should be undertaken if found deficient.

A state law enacted in 1971 to be carried out by the California Division of Mines and Geology provides for the placement of accelerographs throughout the state with one in the Merced area. The accelerograph will measure the effect that nearby earthquakes will have on the ground in the Merced area. In addition, the Uniform Building Code states that every new building over six stories in height with an aggregate floor area of 60,000 square feet or more and every building over 10 stories in height shall be provided with not less than three approved recording accelerographs.

Measures could be taken that would allow the community to better withstand the impact in the event of an earthquake. For example, more flexible water main piping (e.g., ductile iron instead of cast iron) could better withstand groundshaking. In addition, an adequate amount of water storage capacity could ensure a good supply of water. A well organized civil defense procedure could also lessen the impact of earthquakes and other disasters.

OTHER GEOLOGICAL HAZARDS

In the following paragraphs only those hazards that could occur locally are considered and such things as seismically induced waves (tsunamis and seiches) have not been included.

Subsidence

Subsidence is movement in which there is no free side and surface, when material is displaced vertically downward with little or no horizontal displacement.

Local Activity

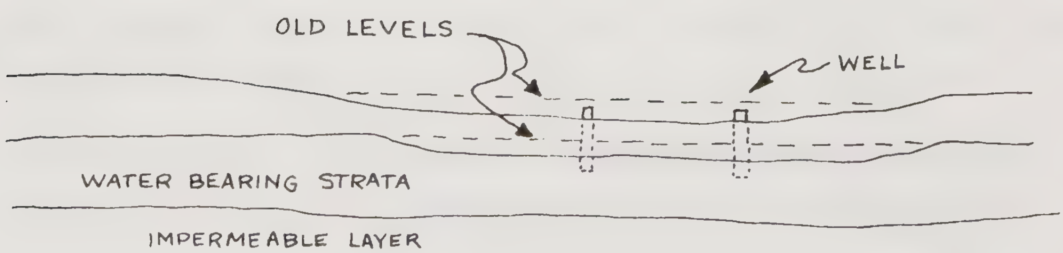
Ground-water withdrawal subsidence within the Planning Area is possible according to the California Division of Mines and Geology (Bulletin 198, p. 4). Such subsidence would involve the compaction of the valley alluvium at depth. It could cause damage to water wells, canals, sewers and other pipelines sensitive to strain and/or changes in elevation.

Mitigation Measures

A preventative measure could involve a water conservation program. If the problem were severe, subsidence could be slowed or stopped by injecting water under high pressure into underground reservoirs being depleted.

Figure III-4

Subsidence Due to Groundwater Withdrawal



Landslides

A landslide is the downward movement of a relatively dry mass of earth, rock, or mixture of the two which becomes loosened from a hillside by moisture. It can be caused by oversteepening of slopes or by excessive watering of normally arid land.

Local Activity

Small landslides covering several square feet have occurred along the banks of both Bear Creek and Black Rascal Creek as part of the natural erosion of the streams and also as a result of human activity along the banks. Areas beyond the present urban development of the City have a potential for landslide activity where the slopes are covered with deep soils or are heavily saturated with ground water.

FIRE HAZARDS

The variety of different land uses and construction types within the City of Merced presents an equally varying potential for fire (Figure III-9, p. III-20). These differences are all taken into account when computing amount of fire flow (water) and duration of flow requirements and the minimum distances from a fire station (Figure III-5, p. III-17). Also, in order to reduce the potential fire hazard, all areas of the City are covered by minimum building setback and width requirements that may vary according to the type of land use. The following sections describe these different land uses and construction types and the problems that are associated with each.[7] (See Appendix III-B for chart: "Classification of Occupancy as to Hazard.")

Fire Potential of Different Land Uses

Mercantile (Retail Stores, Warehouses)

Stores that sell or stock clothing, books, or other readily combustible wares are more susceptible to fires. When they are concentrated

as in downtown Merced, they are especially vulnerable to the hazards of flying brands (e.g., cinders). Also, small stores generally do not initiate fire prevention measures to the extent found in larger stores. Larger stores and warehouses involving readily combustible wares, on the other hand, present a particular hazard when the building arrangement allows a fire to spread rapidly.

Fire resistant roofs can reduce the hazards from flying brands, and a greater awareness of fire prevention measures including a program of inspection could help reduce the incidence of fire. The measures used by the larger facilities, including automatic sprinklers, watchmen, fire alarm systems and better housekeeping would reduce the hazards of fire. Fire officials should continue to be knowledgeable of the floor arrangements of large buildings.

Institutional Buildings

Large public and institutional buildings such as schools, hospitals, and libraries, are special hazard areas in that a greater danger to life and larger values are involved. Also, the floor arrangements of large, institutional buildings tend to allow greater, more rapid spread of fire.

Fire-resistive construction, especially in roofs, partitions and wall finish, and also enclosed stairways and fire walls, will retard the spread of fire. Automatic sprinklers should be required in new construction. ("Losses in sprinklered buildings are probably not more than 10 per cent of losses in buildings of similar character not sprinklered."[8]) Building code requirements should be reviewed periodically to determine adequacy. Management of large institutions should conduct practice evacuations periodically.

Vacant Lots

Vacant lots that are overgrown with weeds or allow the buildup of refuse are a fire hazard, especially during the hot, dry summer season. In 1974, almost half the recorded fires in Merced were grass or brush fires.

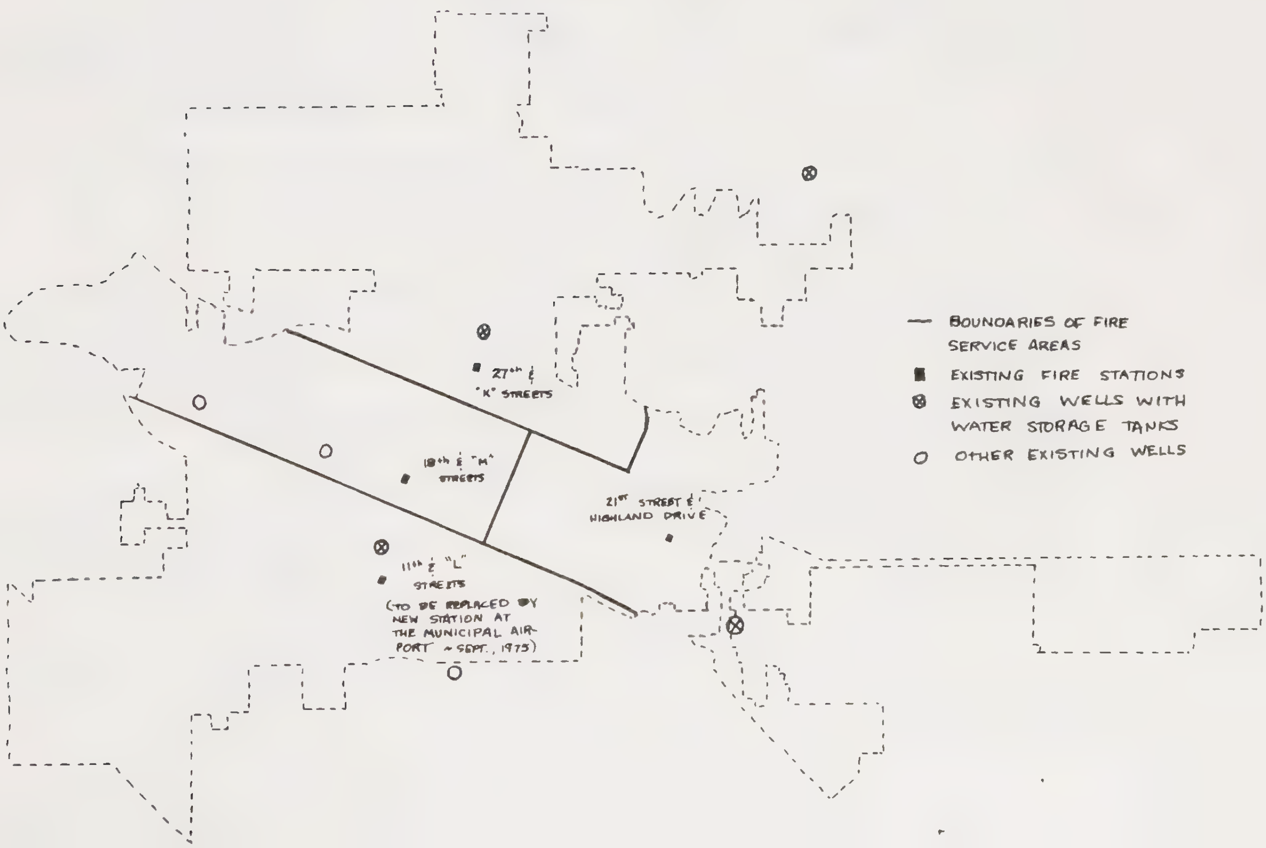
The City of Merced currently has a weed control program which requires weed abatement once a year during the spring. The City Fire Department picks up abandoned vehicles and a "Spring Clean-Up" conducted annually allows people to have bulky refuse picked up without charge.

Dwellings

Although the greatest loss of life from fire occurs in dwellings, there has been little attempt made to develop suitable private fire protection for dwellings, and they must still rely mainly on the fire department for adequate fire protection.

Figure III-5

FIRE SERVICE AREAS AND
WATER SUPPLY FACILITIES



In general, mitigation measures fall into two main areas: (1) strengthening the fire department and its supportive services, and (2) expansion of the fire education/prevention programs. Urban growth has made necessary the construction of additional fire stations. Care should be taken to locate new stations (and if necessary modify or relocate existing stations) so that there is little or no conflict with circulation or land use patterns. In addition, the unusual thread size on City fire hydrants could be changed to conform to national standards and thereby minimize possible problems with regard to mutual aid agreements. (See Figure III-8, p. III-20)

Figure III-6
Fire in Merced

Type of fire	# in 1973	# in 1974
Residential	104	86
Non-Residential		
Assembly	17	15
Mercantile	27	17
Manufacturing	3	4
Storage, Etc.	1	23
Garages/Barns	3	5
Grass or Brush	149	210
Vehicles	98	100

In 1973, one person was killed in a fire and one person was injured.

In 1974, no persons were killed, five were injured.

The leading cause of fires in 1974 was from matches and/or smoking

1974 Preventative Fire Protection

Home Inspections	8,249
Commercial Inspections	1,357
Theatre Inspections	15
School Fire Drills	59
Hospital Fire Drills	46
Lectures to Public	20
Fire Training Classes	29

The average fire loss per building in 1974 was $1,581,13. The fire loss per $1,000,000 valuation in the City was $105.09.

The fire occurrence rate per 1,000 population in 1974 was 4.64.

Discussion of the Fire Insurance Rating System

Several factors are taken into consideration when determining the level of the fire insurance rate.[9] The first step looks at the fire loss experience of the State of California. Next, the Merced City Fire Department is analyzed to determine its quality of operation. The City is also studied to find out which areas are more prone to fire damage. Local building codes and planning standards are reviewed to see what influence they have had and will have on the quality of construction as it relates to fire prevention. These factors together determine the "basic rate" or "class level" of the City of Merced.

Figure III-7

Common Fire Hazards

Matches	Air Conditioning	Paint spraying
Wiping rags	Lamps	Chimneys
Smoking	Fireworks	Heaters
Oily materials	Furnaces	Gasoline
Packing materials	Gas appliances	Electrical wiring

In determining the "insurance rate" of an individual dwelling or other building, additional factors are considered; (1) the type of building and the structural features, e.g., wood frame, masonry, wall finish, roof material, age, floor design; (2) the type of occupancy, e.g., transient, mixed (e.g., apartments over a store), family, business; (3) the amount and quality of private protection against fire, e.g., fire extinguishers, automatic sprinklers, fire walls, fire resistant material; and (4) the exposure from possible fires in adjoining buildings, for example, conditions and type of nearby buildings and land use.

The rating system at the state and city level goes from a Class 10 (unprotected) to a Class 1 (most able to cope with a fire).

Figure III-8

City of Merced Fire Department

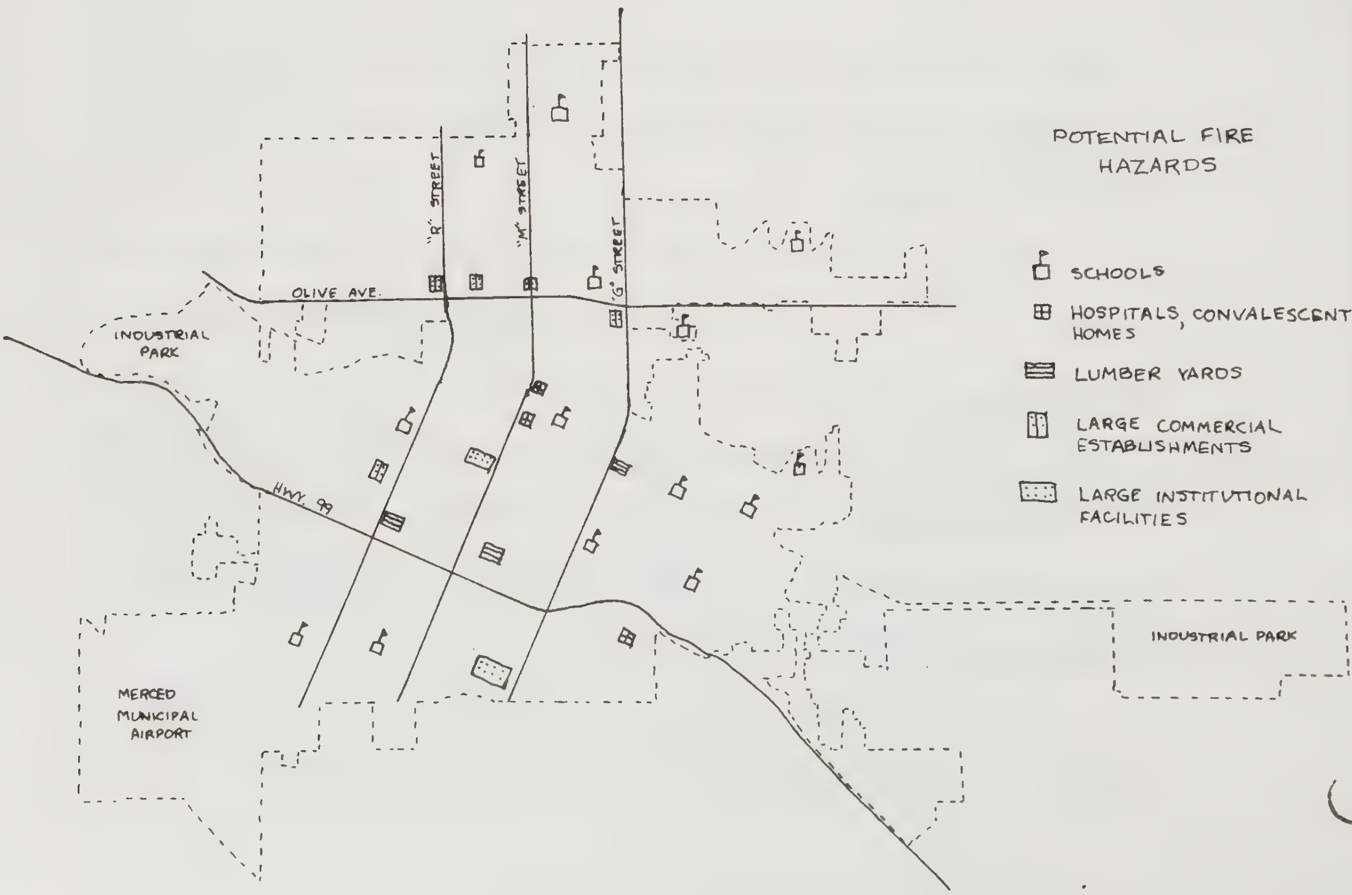
As of May, 1975, the City of Merced Fire Department's fire control equipment consisted of four engine companies (carry and pump water), one ladder company (75'), and several miscellaneous vehicles.

The Fire Department personnel as of May, 1975, numbered 53, of which 50 were involved in fire suppression. There were four volunteers.

The City of Merced Fire Department has a mutual aid agreement with both the County Fire Department and Castle Air Force Base. This agreement enables the different jurisdictions to request aid from one another when necessary.

Figure III-9

Potential Fire Hazards



The insurance rates for dwellings do not automatically change with each of these Class levels (e.g., they do not change from Class 6 to a Class 5 or to Class 4 or any better Class). Therefore, since the City of Merced has a Class 3 rating, it would not benefit individual homeowners if a better Class were obtained. Because the insurance rates of commercial property do change, owners of commercial property could benefit for each step the Class level was improved.

DISCUSSION OF RISK

By definition, risk is a hazard or exposure to loss or injury. Risk can be involuntarily accepted as would be the case in experiencing "acts of God." Voluntary risks are ones accepted with some knowledge of the risk and would include a person's willingness to engage in dangerous sports.[10] A person's perception of risk can be affected by several factors:

(1) If there is familiarity with the risk, it can appear to be lessened. For example, once a person has acquired expertise in a hazardous sport it may appear less dangerous.

(2) If there is a time lag between exposure to the hazard and the occurrence of injury, for example, attending rock concerts and losing one's hearing, the hazard can appear less threatening.

(3) Also, if a high level of sophistication is required for understanding how the risk should be calculated, for example, investing in the stock market, the level or risk may be difficult for the individual to assess.

(4) If the probability of injury or loss is low, the perception of risk is reduced. This factor may help explain why homes are built in 50-year floodplains when the risk of being flooded is known to be 2 percent each year.

(5) Personal experience sensitizes people to certain risks so that even when the probability is low, the risk will not be taken. The father who remembers the "danger" of a childhood sport may not allow his child to participate in the same sport.

(6) The uncertainty of the peril, for example, the evidence supporting but not qualitatively proving that a connection between smoking and lung cancer exists, can decrease the perceived risk.

These factors will influence the willingness to require more stringent standards or reduce the existing standards that have affected the past levels of safety in Merced. In reviewing the Goals and Policies which follow, the relationship between the perceived risk and the actual risk should be understood.

Level of risk can be determined in part by social action. The adoption of building codes by cities and the testing of drugs by the Food and Drug Administration are two activities which help determine the level of risk to be considered acceptable for the people affected. In some cases, social action through regulations, for example, automobile safety devices like padded dashboards, eliminates choice of risk level by the individual. More recently, concern has been developed over risks that are unknowingly taken and the demand for "technological assessment" of relatively new

processes and products is growing. Discovering the harmful effects of pesticides and Thalidomide has helped initiate deeper discussion at the planning stages of other new developments such as nuclear power plants and supersonic transport.

The amount of risk from fire, earthquakes, and other geologic occurrences present to the residents of Merced is already partly determined by standards adopted at other levels of government. The Class rating indicates what the City's existing fire risk is. Level of fire risk is also partly acknowledged in the practice of dividing the City into fire district zones based on the potential fire damage within that zone, each having specific building standards to reduce the risk of a large fire.

The International Conference of Building Officials has placed the entire planning area within Seismic Zone 3 (major damage, intensity VIII) as adopted by the City in the Uniform Building Code. City building code requirements, therefore, are based on the frequency and magnitude of earthquakes which can be expected to occur in this zone.

In light of historical activity, associated damage (only minor), and the degree of seismic risk acceptable to the community, it appears that the City has already taken sufficient measures to reduce seismic hazards. However, as our knowledge of the causes and effects of seismic activity increases, or as State directives require, more stringent measures may have to be taken in the future.

The risk from other geological hazards, for example, landslides and subsidence, is somewhat reduced by requiring environmental impact evaluations in areas where these hazards already exist. The degree of protection from these hazards that will be mandated by government in the future will depend upon the accepted level of risk.

SEISMIC SAFETY/SAFETY ELEMENT GOALS AND POLICIES

GOALS

1. To provide the City residents with reasonable safety and well-being from earthquakes, seismic related activity, and other geologic hazards.

2. To insure a reasonable level of protection of life and property from the hazards of fire.

POLICIES

Reasonable Safety from the Hazards of Earthquakes and Other Geologic Activity

1. To continue to require that new development meet the standards of Seismic Zone 3.

2. To reduce the potential danger from earthquakes and seismic related activity from existing buildings where necessary.

3. To analyze and reinforce where necessary water tanks built prior to the adoption of the current seismic standards.

4. To provide water mains that are resistant to seismic effects; e.g., ductile iron.

5. To inspect architectural trim to determine its ability to withstand seismic activity and require reinforcement or removal where necessary.

6. To provide additional storage facilities to insure an adequate supply of water in the event of seismic activity.

7. To provide for the reasonable safety of residents in the event of major disaster by continual emphasis by responsible officials of the importance of a current disaster plan for the City of Merced.

8. To establish a process (e.g., disaster simulation) whereby the City of Merced systematically encourages review of and familiarity with the most current community disaster plan by those in local government and other local residents who hold responsible positions for the execution of said plan in times of emergency.

9. To provide for the reasonable safety of residents in the event of major disaster by continual emphasis by responsible officials on methods whereby information and instructions will be disseminated to residents in the event of such disaster (e.g., radio and television announcements and instructions).

10. To make an effort to retain a high level of ground water supply in order to reduce the possibility of land subsidence, including the initiation of an educational program to discourage excessive, inefficient uses of water as well as a possible enforcement program to eliminate careless water usage.

11. To monitor areas that are subject to landslides and require modifications of proposed development to eliminate potential danger.

Reasonable Safety from the Hazards of Fire

12. To analyze proposed fire station locations to determine land use and circulation conflicts and to provide modifications where necessary to reduce the conflict.

13. To provide additional fire stations as expansion of the City occurs, including one in the area of Loughborough Drive and "R" Street within five years.

14. To provide an adequate supply of water with ample pressure in the event of fire, the following recommendations of the Insurance Services Office of California should be seriously considered:

> 1. A gridiron of 8-inch or larger pipe...with intersecting mains in each street in high value districts. 2. Additional cross connections be provided so that lengths of six-inch pipe on the long side of blocks in residential areas will not exceed 600 feet. 3. All valves be inspected annually and large valves more frequently. Valves should be kept in good condition and suitable records of inspections and repairs maintained. 4. Additional hydrants be installed in residential districts so that the average built-up area served will not exceed 120,000 square feet. In general hydrants should be spaced every 500 feet in these areas. 5. Hydrants be inspected twice a year and after use; suitable records of inspections and repairs should be maintained.

15. To adopt national standard sizing on fire hydrant outlets in the City of Merced.

16. To continue to provide fire prevention information through the schools, public interest groups and other facilities and people.

17. To expand or establish an inspection program to include the following recommendations by the Insurance Services Office of California:

> 1. Fire prevention inspections of all buildings other than dwellings be made twice a year, except hazardous occupancies [see Appendix III-B] should be inspected four times a year. 2. A program of adequate re-inspection of electrical wiring and equipment be established.

18. To expand the present vacant lot weed abatement program to include a height limit on weeds during the dry season (mid-April through mid-November) in both vacant and developed lots.

FOOTNOTES

1. California Council on Intergovernmental Relations, "General Plan Guidelines," Sept., 1973, p. IV-23.

2. Ibid., p. IV-36.

3. William C. Putnam, Geology, New York: Oxford University Press, 1964, p. 215.

4. Frank Press, "Earthquake Prediction," Scientific American, Vol. 232, No. 5, p. 17.

5. Ibid., p. 18.

6. Putnam, p. 210.

7. International City Managers' Association, Municipal Fire Administration, Washington, D.C.: I.C.M.A., 1968 reprint, pp. 7-8.

8. Ibid., p. 9.

9. Ibid., pp. 22-26.

10. Joint Committee on Seismic Safety to the California Legislature, "The Setting: Some Background Thoughts on Risk" from Earthquake Risk, (Conference Proceedings), October 31, 1971, p. xi.

BIBLIOGRAPHY

Anderson, Don L., "The San Andreas Fault," Scientific American, November, 1971.

California Council on Intergovernmental Relations, "General Plan Guidelines," September, 1973.

California Division of Mines and Geology, Bulletin 198, (no date available).

__________ "One Hundred Years Later," from California Geology, March, 1972.

California, Joint Committee on Seismic Safety to the California Legislature, "The Setting: Some Background Thoughts on Risk" from Earthquake Risk, (Conference Proceedings), October 31, 1971.

Iacopi, Robert, Earthquake Country, California, Menlo Park: Lane Books, 1964.

International City Manager's Association, Municipal Fire Administration, Washington, D.C.: I.C.M.A., 1968 reprint.

Merced County, Planning Department, "Safety in the County of Merced," 1974.

Press, Frank, "Earthquake Prediction," Scientific American, Vol. 232, No. 5.

Putnam, William C., Geology, New York: Oxford University Press, 1964.

Stanislaus County, California, Environmental Resources Management Element, 1974